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THE VALUE OF SPORT TO THE VETERINARY PROFESSION.

ONE sometimes wonders whether our younger members realise fully the value of sport and its adjuncts to the veterinary profession; not only as a means of livelihood, but as a channel in which it is a pleasure to practise. The difference made by the presence of a pack of hounds in the neighbourhood is not to be measured only by what is gained financially from attention on the hunt kennels, but the class of practice which it engenders is of a totally different character to that of a district which is solely agricultural. The same applies to the presence of a racing and breeding stud, for thoroughbred horses are costly products to produce and keep, and the more valuable the patient, the more the veterinary surgeon is required, and the better are his fees. During the last few years the same has applied to dog patients, and the modern up-to-date practitioner is equally pleased to learn of the arrival of a new kennel in his neighbourhood, especially if of the the present-day popular greyhound racing breed; and if he can combine the veterinary control of a Greyhound Racing Track with his everyday practice he has indeed had a "lucky birthday." The rise of the sport of greyhound racing has been phenomenal, and its success as a clean British sport is now assured. The chase of the electric hare has done away with any semblance of cruelty in the actual sport itself, and its popularity as an evening sport for the working man can be judged from the following figures, which were supplied to some 300 members and guests (including thirty-two Members of the Houses of Parliament) who dined together at the Savoy Hotel, in London, on February 8th.

Greyhound racing was introduced into England in 1926, one of the chief promoters being Major Lyne Dixon, a retired member of the Royal Army Veterinary Corps. It made its debut at Manchester, and speedily spread to London, the total attendances in 1927 being 5,656,686, and in 1931 the figures reached the gigantic total of 19,906,917 people. Further details are given on page 88, and a sport which will give such a phenomenal progress in so short a time means necessity for control, valuable dogs to be bred and kept free from epidemics of disease, increase of intelligent employment, and the circulation of money in every possible way; including a very substantial addition to the income of the veterinary profession; and sport must always run side by side with veterinary science.

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General Articles

AZOTURIA.

By W. P. BLOUNT, F.R.C.V.S.

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COMPARATIVELY few diseases of domestic animals have been studied fully from the standpoint of biochemistry. Dryerre and Grieg's investigations into the causation of milk fever, and the studies of Green as biochemist, in association with Theiler and Du Toit as veterinarians, on the phosphorus metabolism of Lamsiekte and Styfsiekte in South Africa, are two specific instances of the value of research from the chemical standpoint. Consequently the veterinary profession will no doubt gladly welcome Professor Carlström's important work on the ætiology and pathogenesis of azoturia. ("Ueber die Ætiology und Pathogenese der Kreuzlöhme des Pferdes-Hæmoglobinæmia paralytica." Carlström, Birger, 1931. *Skandinavisches Archiv. für Physiologie*, Bd. LXII. Also in monograph form, Walter de Gruyter & Co., Berlin and Leipzig, 1930. Pp. 182, figs. 6, tables 25, references 160).

Professor Carlström has investigated his subject with great thoroughness; using modern biochemical and physiological methods, his interpretations and lines of reasoning are worthy of study by all interested in the problems of disease investigations. After perusing the results of Carlström's researches one cannot fail to recognise his general excellence, but, at the same time, it is a pity that the full picture of the pathogenesis is not completed. It is to be hoped that the author will continue his investigations to a successful conclusion.

Theories of Causation.—Numerous theories have been propounded concerning the cause of azoturia, some having experimental facts to substantiate them, thus: Bollinger.—Hæmolytic toxin from proteids liberated by cold and work. Cadeac.—Streptococcal infection. Csokar.—Spinal myelitis. Dieckerhoff.—Protein autointoxication produced from muscle tissues (by enzymes) not used during rest. Fröhner.—Cold reflexly acting on muscle metabolism liberating muscle-colouring matter. Hertha and Wester.—Excessive production of lactic acid during work. Hink.—Decomposition products forming rapidly in used muscles during rest. Hobmair.—Toxic allergens of foodstuffs (like Vicia sativa), a condition of anaphylaxis resulting after preliminary sensitisation in an injured intestinal epithelium. Hutyra and Marek.—Associated work, rest, R.B.C's., and believed in an autointoxication theory. Lignières.—Gram-positive streptococcus. Lucet.—Nephritis. McFadyean.—Rich foods, excess of red blood corpuscles, and their subsequent breakdown during work. Ohler.—Rapidly breaking down glycogen leading to myositis and nephritis. Schlegel.

—Streptococcus melanogenes. Williams.—Increased excretion of urinary nitrogen.

Some of these theories Carlström rightly dismisses as untenable ; many were twenty or more years old, and consequently were propounded before the more modern views of the physiology of muscle metabolism were known. In spite of time, however, the clinicians' conclusions have remained the same ; thus it is generally accepted that azoturia is common to the draught horse, and although cases are recorded in a zebra and donkey, the disease is not seen in typical form in animals other than equidæ. A period of rest following work is almost as essential as is the continuance of high (rich) feeding during the idle period. After a few days of such rest (shortly after the animals are put back to their normal work involving muscular exertion) the disease commences. It was said to be seen more commonly in mares, and also during cold weather. Horses between the ages of five and ten were mostly affected, although Kleinpaul records an instance in a suckling colt.

Clinical Signs.

These are well known, and need but recapitulation. Usually within an hour of leaving the stable the horse becomes lame and unsteady behind. It fails to progress, and becomes recumbent ; the muscles of the croup are considerably hardened (sometimes tender), and any urine passed is of dark discoloration (dark tinged). Death occurs in 20 per cent. to 50 per cent. of cases in spite of all treatment. The factors—work, high feeding, rest, resumption of work—and commencement of the disease appear to be indisputable, and Carlström consequently directs his particular attention to the question of muscle metabolism.

By some writers on the subject, " cold weather " was considered essential, but the probability is that this factor merely causes animals to be rested instead of worked, and therefore it is incidental, subsidiary, and not of major importance. The non-infectious nature of the disease condemns the theory of a bacterial origin ; but biochemical investigation alone could decide whether or not the disease was connected with excessive protein intake, muscle metabolism, or the like.

McFadyean, Fröhner, and others, had disproved Williams' original theory of disturbed excretion of urea, but whether the urinary pigment was of gæmatogenous or myogenous origin was still uncertain. McFadyean found an excess of R.B.C's in the blood, Hutyra and Marek a reduction ; Carlström, using the hæmatocrit (cell volume method), found an increase of 11 per cent. in cases of azoturia (40 per cent. cell volume) over the normal (36 per cent.), thus tending to support McFadyean. However, owing to the fact that sweating is one of the chief features of the disease, a concentration of blood cells could easily occur in different stages of the attack ; such results are therefore inconclusive. Carlström finds the hæmoglobin factor equally valueless. Normals (10) 83 per cent. ; azoturia (13) 82 per cent. Hutyra and Marek give 75 per cent. as normal, and less than 70 per cent. in azoturia. Owing to the fact that hæmoglobin estimations are normally subject to an error of from 7–10 per cent., such figures are uncertain.

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That the urinary pigment was not of hepatogenous origin is disposed by Carlström's use of the modified van der Burgh's reaction, and also by the clinical observation that icteric membranes are not present in typical cases. The use of the spectroscope clears the position. Providing that Carlström's methods and statements are confirmed, it appears definite that *the discoloration of the urine in azoturia is due to a content of muscle pigment* (myohæmation of MacMunn ?), *a derivative of myo- and meta-myoglobin, and not to hæmoglobin.* He finds normal horse plasma free from blood pigments, and even when the urine of animals suffering from azoturia is strongly discoloured, the plasma pigmentation is surprisingly small. It is shown that injections of hæmoglobin may produce hæmoglobinæmia, and no hæmoglobinuria, whereas similar injections of muscle pigment discolour both urine and plasma; obviously this is dependent upon a variation of the renal threshold for the passage of pigments, and the capacity of the reticulo-endothelial system (particularly of the liver) to deal with considerable quantities of hæmoglobin in the normal way *via* the bile. He was unable to demonstrate hæmoglobin in the urine spectroscopically, even as an admixture to the muscle pigment, in azoturia. In view of these facts, Carlström suggests deleting the names azoturia and equine hæmoglobinuria, substituting in their place myoglobinuria, indicating that the pathological pigmentation is of muscular origin.

It is certain to be difficult to effect this change of nomenclature, for, having been established as azoturia in this country for half a century, the term " myoglobinuria " will strike an unfamiliar note. Carlström's is a better term from a scientific point of view, and should be encouraged, more particularly as the ætiology and pathogenesis of the disease appear to be unrelated to nitrogenous metabolism. Incidental to his study of the urinary pigmentation, Carlström examines (in both healthy and diseased animals) the osmotic resistance of the red corpuscles, the dry matter of the plasma, creatine, amino-acids, residual nitrogen, inorganic phosphorus and calcium, and the blood pH. The fact that his data for normal horses is included in the tables, gives an added value to the paper, inasmuch as the veterinarian has few such references.

As the author's main investigations concern the metabolism of muscle, it is perhaps as well to summarise briefly our knowledge of this subject. The chemical changes which occur during muscular contraction and relaxation may be divided into two groups: the first, which can take place in an atmosphere free of oxygen, consists in the transformation of stored muscle glycogen $(C_6H_{10}O_5)_N$ by way of hexose diphosphate $C_6H_{10}O_4(H_2PO_4)_2$ into lactic $(C_3H_6O_3)$ and phosphoric (H_3PO_4) acids. The second change is aerobic (the oxygen normally being derived from the red corpuscles), one-fifth of the lactic acid is burnt up into CO_2 and water, whilst by a reversible enzymic process the remaining four-fifths lactic acid is reconverted into glycogen, the evidence suggesting that the phosphate radicle acts as a catalyst.

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It is known that the musculature of the horse stores more glycogen than that of most other animals, and Carlström has shown that the more " fit " a muscle is, so that muscle will have greater powers for the conversion of blood glucose into muscle glycogen. During the resting period following muscle exertion, a rapid storage of glycogen occurs ; this persists for a few days, and then the rate of storage declines steadily. Carlström shows an even more interesting fact, *viz.*, that those muscles which during rest are used least (*i.e.*, those muscles not taking any great part in the maintenance of posture) have a more pronounced glycogen content, notably in the m. psoas major.

Carlström's methods for the determination of lactic acid and muscle glycogen are ingenious. Small portions of the affected muscle are excised during life, and immediately dropped into liquid air in order to limit or prevent chemical changes continuing, then by a micro-technique the estimations are carried out.

The pathological picture in azoturia is somewhat as follows : During the rest period, and under the influence of a carbohydrate-rich diet, excessive storage of glycogen commences (more particularly in those muscles of the croup region which are least active ; this storage is at its maximum three or four days after the cessation of work. With the commencement of exercise, the mechanism for the conversion of glycogen into lactic acid is initiated, and lactic acid is produced in amounts far in excess of physiological requirements (Table II). If the circulation is good, this acid gets transported to other parts of the body, and by combination with $NaHCO_3$ neutralisation occurs. Should the animal be susceptible to the hyper-production of sarcolactic acid, and the circulation fail to remove this, then a vicious cycle is established. The acid remains in contact with the muscle cells, lowering the local pH so that an acid medium is produced—local buffering effects will attempt to neutralise this—but as the acid is absorbed by the cells, so swelling takes place, which by compression on the capillaries causes a vascular stasis. An excess of lactic acid in a muscle causes " fatigue," and if this excess is greater still, partial or complete coagulation of the muscle proteins takes place ; this will inevitably be followed by further degenerative processes. This latter change is really the same as in rigor mortis, and appears to be co-related to a localised hyper-production of lactic acid.

Green has pointed out that the probable mechanism of these degenerative changes is in the proteolytic enzymes normally resident in nearly all body cells. Tryptic-like ferments act only in alkaline media, whereas native proteins (albumins and globulins) are acted on by peptic-like enzymes in acid media. Once this occurs erepsin-like ferments come into play ; they are peculiar in that although able to function in both acid and alkaline surroundings, they cannot act on unaltered native proteins. Following this autolytic process, presumably muscle pigment is liberated, and eventually is excreted into the urine to produce typical discoloration. Apparently in azoturia we have an ante-mortem rigor of certain localised muscles with the physical appearances of rigor mortis.

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TABLE I. (CARLSTROM.)

Statistics from the The Stockholm Veterinary Clinic, 1919–1930.
Incidence of Azoturia.

Days	1	2	3	4	5	6	7	8	9–14	over 14 days.	1	2–4	5–14
No. of animals affected	9	45	40	18	9	5	7	9	5	0	9	103	35
Mortality	1	23	19	8	2	2	0	1	1	—	1	50	6
Percentage Mortality	11.1	51.0	47.5	44.4	22.2	40.0	0	11.1	20.0	—	11.1	48.5	17.1

TABLE II (AFTER CARLSTROM).

The Lactic Acid and Glucose Content of the Blood of Horses before and after Exercise.

	Normal.		After 15 minutes exercise.		After 45 minutes exercise.		45 minutes after exercise complete.	
	Lactic Acid.	Glucose.	Lactic Acid.	Glucose	Lactic Acid.	Glucose	Lactic Acid.	Glucose.
Normal horses	9.9	86.7	20.0	70.8	10.6	84.8	12.3	92.4
Normal horses after 3 kg. molasses...	12.9	96.8	22.8	75.0	13.5	96.8	13.9	98.2
Azoturia (slight)	23.8	108.0	—	—	—	—	—	—
Azoturia (marked)	82.1	158.3	—	—	—	—	—	—

Concerning the termination of this pathogenesis, Carlström does not appear to have paid so much attention. Presumably certain of the products of muscle degeneration are toxic in nature, and cause marked lowering of vitality. This is of extreme importance in view of the fact that generally, in severe cases, the animals knock themselves about in their efforts to rise ; lacerations or abrasions of the skin follow, and fatal septic conditions frequently ensue. Nephritis appears to be a common feature at post-mortem examination, but this would appear to be of secondary importance.

That this hypothesis of Carlström is no mere theory is confirmed by his efforts to reproduce the disease artificially. He has successfully initiated the clinical picture by feeding 3 kg. molasses daily, and at the same time associated with this the work, rest, work predisposing factors. Dietetic measures alone did not produce myoglobinuria. In further support of his hypothesis, the author injected lycopodium and/or starch granules inter-arterially. This produced a blockage of the capillaries of certain muscles, and owing to the inability of the tissues to receive oxygen (again when all the predisposing factors are present) the blood then showed typical signs of azoturia, although no myoglobinuria developed.

Two points in Carlström's hypothesis should be noted, *i.e.*, throughout the whole experimental work, and from old-standing clinical observations, certain animals appear more susceptible to the disease than others, but wherein lies this defect, we are at present not able to determine. Secondly, Carlström's reproduction of the disease involved heavy carbohydrate feeding (3 kg. molasses), which is hardly comparable to diets as fed in this country ; further, nearly all the older investigators stressed the fact that the rick feeding which was known to exist consisted in the liberal use of nitrogenous foodstuffs. Perhaps as their mind was always on the look-out for protein disorders (azoturia), they failed to notice any excess of carbohydrates ; or, were the large quantities of amino-acids partially converted into muscle glycogen ? Hink and Humann found that ½–1 lb. sugar *per os*, repeated several times, was good treatment ; this would appear contrary to Carlström's hypothesis, although if the circulation to the muscles is cut off, the glucose would never reach them to be utilised. F. S. Lee, however, says that dextrose hinders rigor-mortis formation, which presumably is why Hink used it.

Prophylaxis.

(1) Where draught horses are necessarily inactive for any short period (one to fourteen days), it is essential that they receive adequate daily exercise, which should commence with the first day's rest. (2) Restrict the diet, particularly carbonaceous foods like maize, rye, molasses, etc. Carlström does not appear to attach much importance to high protein feeding, but obviously such a practice should be curtailed during rest ; all indicating that good meadow hay is adequate and excellent. (3) Where daily exercise is impossible, the stabling of horses in loose boxes would appear to give them sufficient freedom to act as a prophylactic to azoturia.

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THE TRANSMISSION OF PULLORUM DISEASE (BACILLARY WHITE DIARRHŒA) AMONG ADULT STOCK.

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In the last Special Poultry Number of this Journal (1931) we recorded the results of some experiments in which we showed that transmission of pullorum disease takes place in adult stock between reactors and non-reactors. Since that article was published the experiments detailed therein have been continued, and further results are now available. Two experiments were described: (*a*) six non-reactors were penned with eighteen reactors in a grass run 67 ft. by 42 ft.; and (*b*) six non-reactors were penned with two reactors in a grass run 15 ft. by 17 ft.

In experiment (*a*) the six non-reactors had remained non-reactors for eighteen weeks. No change occurred till nine months after the experiment was begun, when one non-reactor (No. 142) reacted at a titre of 1 in 160, and continued to react on each occasion when tested every two weeks for three months, when it died suddenly. Its final reacting titre was 1 in 640. Unfortunately, a post-mortem examination was not made. Eleven months after the experiment began a second non-reactor (No. 165) reacted at a titre of 1 in 160. It continued to react, and finally was killed two months after its initial reaction was observed, when its titre was 1 in 320. Post-mortem examination showed many pathological, typical B.W.D. ova, and *S. pullorum* was recovered from them with great ease. It is of interest to note that two of the original reacting birds in this pen had never shown a reacting titre of more than 1 in 80. They have been killed, and *S. pullorum* was isolated from their ovaries. A third original reactor was of interest in that its original titre of 1 in 160 rose to 1 in 640, and then dropped gradually in four months to 1 in 80. No evidence of pullorum disease or *S. pullorum* could be found on post-mortem.

In experiment (*b*) no further non-reactors became reactors. The second original non-reactor which reacted (No. 471) remained a reactor for eleven months, when its titre reached 1 in 640. It was then killed, and was shown to be typically affected with B.W.D.; *S. pullorum* being recovered from the typical B.W.D. ovary. The two original reactors used in experiment (*b*) had shown titres of 1 in 1,280, and 1 in 640 almost continually during the course of the experiment. We were unable to isolate *S. pullorum* from their excreta on fourteen occasions. Recently experiment (*b*) has been repeated, *i.e.*, two reactors were penned with six non-reactors in a grass run 17 ft. by 17 ft. One non-reactor became a reactor in four months. It reacted for four weeks up to 1 in 160, then suddenly failed to react. On post-mortem examination no

evidence of pullorum infection could be found. The control non-reactors (group (*c*) of the previous article), now thirty-two birds, have remained non-reactors throughout. They have been tested by all the recognised methods. The experiments have now been terminated.

Summary and Conclusions.

(1) The results recorded confirm our previous observations that transmission of pullorum disease may take place in adult stock from reactors to non-reactors. (2) The size of the space in which the birds are confined materially influences the time interval of the transmission, *e.g.*, in experiment (*a*) (large space) nine months elapsed before evidence of transmission occurred, while in (*b*) (small space) in six weeks a non-reactor became infected. (3) There is also some evidence that birds which lose their power of reacting, or in which the titre falls and remains low, are not infected with pullorum disease. The probable explanation is that the *S. pullorum* failed to be located in the ovary or any other tissue. (4) There is definite evidence that a bird reacting constantly at a titre as low as 1 in 80 is a true carrier of pullorum disease (*S. pullorum* was recovered from the ovary of two such birds).

REFERENCE.

Warrack, G. H., and Dalling, T.: VETERINARY JOURNAL, 1931, 87, 24.

THE MENTAL ABILITY OF THE LOWER ANIMALS.

By Dr. WILL W. PETERSEN,

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How low in the animal system we wish to describe a soul or a psyche depends, of course, mainly how comprehensively we define the mental abilities. In the very narrowest limitation of the word, many philosophers and naturalists are inclined to credit the vertebrates alone with a real mental life, and, naturally, there is a considerable analogy between the structure and the function of the nervous system on the one side and the features of the psychical elements and modes of expression on the other. The vertebrates alone possess a cerebral matter, particularly in respect to the grey substance of the brain cortex, which to a rather considerable extent is analogous to the human brain. It cannot be disputed that the brain-cortex is the real basis of the soul in such animals where it exists. Quite another thing is whether other organic structures than the brain cortex can be the basis of a soul.

The protozoa have no nervous system; these primitive beings are, nevertheless, not at all machines. The unicellular animals are just as much endowed with life

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as are the higher types of the metazoa, but the range of the many-celled animals is far more extensive. The amœba, f.i., has only the simplest type of mind, limited to that which is necessary to guide her movements. Every act of the protozoa is derived from a stimulation, and the result of the stimulation is always identical with the action itself. In the life of the protozoa the perception and the expression (cause and effect) is just the same.

Among the multi-celled animals the sponges are beings of simple stimulation. The only visible expression of life in the sponges appears to be the ability to allow water to pass through their bodies, and filter the particles from the water. When the particles are digested the sponges discharge the indigestible remains. This is, generally speaking, the sum total of activity of the sponges.

The majority of the coelenterates are also beings of stimulation. The little fresh-water hydra, f.i., catches her prey by means of her tentacles, then paralyses the prey with her nettle threads, entangles it, carries it towards and into her mouth, and by contractile movements passes it down into her body, where digestion then takes place. Through experiments we know that ordinarily the " food response " can be brought about only by contact with something edible, and just the same is the case with one of the colony-forming hydroids (*Tubularia crocea*) ; when choosing between a grain of sand or a piece of meat placed in contact with the tentacles, the animals will only make a mistake should they be very hungry.

With the actinians we have a somewhat higher species. These animals have a loosely diffused nervous system. Certain sea anemones live on the under side as well as on the upper surface of rocks. If we catch some of these animals and immediately place them in an aquarium containing artificial rocky walls, they will take up a position corresponding to the one they occupied on the natural rocks, but the above-named tendency will quickly disappear if the animals are prevented from taking their habitual seats for a day or two. An animal endowed with a conscious memory would not forget his customs so quickly.

Concerning the echinoderms, we may refer to the well-known palisado experiment, showing how a star-fish (*Asteria rubens*, f.i.) can release himself after being confined on a flat surface by needles located close to centre of body, and between each arm. Furthermore, trials have been made of placing a star-fish on a table in such a way that the tip of only one of his arms touches the surface of the water in a tank held near the edge of the table ; immediately the animal will make a move back to his right element. But if we place the animal on a narrow board in such a fashion that the ends of two diametrically opposite arms just touch the surface of the water, the animal is quite at a loss what to do ; he will remain undecided.

Regarding the worms, the Planarians and the Annelides, we would remark that the common fresh-water flatworm (*Planaria maculata*) can follow the trail of other specimens of his species ; and with respect to the mental qualities of earthworms, we know that one of their strongest instincts is the well-known

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plugging up the mouth of their burrows with leaves. Do the earthworms possess the ability to judge, either before or after having drawn an object close to the mouths of their burrows, how best to drag it in ? Do they profit by the results of experience, or is the behaviour of the worms in closing their burrows nothing but an outcome of pure and simple unconsciousness ?

The molluscs may perhaps sometimes learn by experience—getting used to one stimulus or another ; we have to grant that snails, f.i., may have a rather strong " homing instinct." We know that the common limpets (*Patella*) will return to their dark pits in the rocky walls after a foraging expedition, and on the homeward route they will follow the track of the outway journey. Broadly speaking, we dare say that the limpets have a memory of the locality : they can recognise their nearest surroundings.

As regards the arthropodes, there is a deal of psychological interest to note. Experiments with crabs (*Carcinus granulatus*, f.i.) in very simple labyrinths, limited to a right and a wrong path, teach us that these animals are beings with rather small inventive power. An experiment showed that fifty repetitions were not sufficient to perfectly teach a crab the right path. When the investigator placed a crab in an aquarium with a wire mesh partition in the middle, and an opening in the centre for access to the food on the other side, the animal under test would never learn to go straight to the opening.

In studying spiders, we consider their weaving of the web is without comparison the most interesting feature ; but there are, of course, many other interesting features of psychological value ; we may refer to the subterranean life of the tunnel-building spiders, and the submarine life of the water spiders in their bell-shaped, air-filled webs. With one of the spiders (*Lycosa saccata*), which carry their egg-case along with them, I have made the following experiment : I caught a spider, and holding the animal with two fingers, I tore off her egg case, and placed it between two other fingers of the same hand ; then I released the spider. One would have thought she would anxiously and immediately tumble down from my hand, and quickly try to make her escape ; but, on the contrary, the animal remained on my hand, and at once made for her egg case, clung to it, and tried to recapture her property. Later I caught the spider and placed her on my hand, but this time at a somewhat greater distance from the egg case. The same action was repeated. At last I gave the egg case back to the spider, and she ran away immediately and disappeared in the grass.

The student of animal psychology finds his Eldorado within the class of the insects with its richness of species, and he will find herein a field which is studied in all its varieties by numberless investigators ; but, of course, we are unable to even give a hint of the majority of items of interest concerning the mental life of the insects. We would only write that the final result of the observations and experiments, especially as regards bees, wasps, ants, and other famous representatives of the class, is quite sufficient to illustrate that in the world of insects it is the psychology and not the physiology which must be placed above all.

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The highest invertebrates can in some way assess the predicate of intelligent beings; and we think it quite certain that they, as regards the psychological phenomena, outweigh the lowest developed vertebrates. In the hierarchy of insects it is possible to demonstrate, f.i., the existence of topographical memory, power of communication, and the utilisation of individual experience, while the most marked purpose in the life of the primitive amphioxus or the lancelet is expressed in swimming, appetite for food, and instinct of propagation.

BACILLARY WHITE DIARRHOEA, OR PULLORUM INFECTION, IN ADULT HENS.

By Dr. T. VAN HEELSBERGEN,

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It is my intention to give my views on a complaint which I propose to call the remote effects of pullorum infection in the young chicken. I have already mentioned in a previous article that millions of chickens succumb annually from bacillary white diarrhœa, but we also know that many thousands of adult hens may be added to this large number of victims. It was formerly supposed that when a chicken recovered from pullorum infection the bacteria remained in the ovary without seriously affecting the individual bird, but we know now that, as a rule, this is by no means the case. It seems that during the first laying period, especially when it has reached its height in the months of April, May and June, the *Bacillus pullorum* begins to develop its injurious action in the hen. Whatever the reason for this may be, which I shall not dwell upon in this article, the fact remains that during the period alluded to numerous pullets fall victims to pullorum infection daily. The number of victims is so great, that during that time they form by far the greater part of poultry sent to us for scientific investigation.

The manifestation of symptoms of the affected hens depends on the time the disease has lasted. In using the word disease here, I mean the more or less acute final stage of the previous chronic or latent infection. This final stage or climax may run a course varying from a day to many weeks. Should the progress of the malady be short in duration, one seldom observes more than a sick bird with purple comb or wattles. This latter is probably the result of the heart being usually severely involved in the complaint. Sometimes one gathers that hens are found dead in the run without having shown any signs of disease during life. When the final stage of this chronic pullorum infection is of longer duration, diarrhœa, listlessness, and emaciation are frequently observed. There are also signs of chronic inflammation of the oviduct present, which are often shown by congestion and protrusion of the lining membrane of the cloaca. Hæmorrhage from the cloaca sometimes arises, and which is an inducement for other hens to peck at the organ so as to obtain the blood. There is also a diminution in the

number of eggs. Inflammation of the oviduct may give rise to blood appearing in the egg or on its shell, or to soft or shell-less eggs. Similar hæmorrhages may eventually be found in inflammation of the ovary.

It should, however, be borne in mind that at any given time all the symptoms may only be observed in a few hens in the flock, so that the flock as a whole may have all the appearances of being in good health. But in spite of this, when one encounters typical cases of the disease in a flock one should always treat it seriously, and assume that the flock is invaded by the pullorum infection. It all depends now on the degree of distribution of the infection in the flock, whether a large or small number of hens will fall victims sooner or later to the pullorum infection or not. The affected birds already begin to sicken towards the end of autumn when the pullets are about seven months old, but the greatest mortality, as mentioned above, is found in the months of April, May and June.

It is not absolutely known whether pullorum infection does assume the character of a fixed contagious disease in adult hens, but this is quite possible, and on this point we are in agreement with American investigators, who are of opinion that such instances do occur. Mortality then becomes great, and the hens show the typical lesions of typhoid or Klein's enteritis, as a bronze appearance of the liver and inflammation of the mucous membrane of the intestine. Besides, the typical lesions of pullorum infection are also encountered as mis-shaped yolks, peritonitis, inflammation of the oviduct, as well as heart, lung, and intestinal alterations. It is, of course, possible to explain such cases in another way by assuming that they are those of typhoid, associated with chronic pullorum infection in the flock. In reality, a case of mixed infection. It remains, therefore, an open question.

One can place the internal pictures observed in infected fowls under various headings, according to the degree or extent to which the malady progresses. The most frequent picture is that of inflammation of the ovary and peritonitis. The first thing that strikes one in this picture is the abnormal moisture of the mesentery, which very often contains between its folds a yellow, sticky mass, which is either an inflammatory exudate or a mass of yolk from the burst ovisac. In pullorum infection it is always the ovary that is involved in the course of the disease, and it generally forms the chief seat of mischief. One finds mis-shaped yolks attached by either a short or long pedicle or stalk; also yolk sacs whose contents are either coagulated or sometimes of blood. A rupture of the yolk sac with internal hæmorrhage and death is often the result of this disease. It is sometimes quite easy to recover *Bacillus pullorum* in pure culture from lesions of the yolk. This clinical picture shows intense swelling of the spleen, which reaches to the size of a small chestnut. It is often accompanied by enlargement or swelling of the liver, which is sometimes extremely broken down, and gives rise to hæmorrhage. In some cases it has a bronzed appearance, which I am not certain should be attributed to pullorum infection, although I consider it is quite probable. The symptoms outlined above occur without

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doubt very frequently, and more than a case of it is observed by us daily during the months of April, May and June. Some other cases show that the heart is involved to a more or less extent in the process. At times it is the muscle of the heart that is extensively affected, whilst in many other instances inflammatory tumour-like lesions are observed. These lesions vary in size from a pin's point to that of a hazel nut. As a rule pericarditis, with a sero-fibrinous exudate in the pericardial sac, is encountered. The heart, together with the pericardial sac, may be enlarged from twice to three times its normal size.

It is generally possible to isolate the causal micro-organism, *Bacillus pullorum*, from the inflammatory lesions of the heart. Necrotic lesions, the size of a pin's point, are often found in the liver. The lungs of the affected fowl are usually normal. In bacillary white diarrhœa in the young chicken, the lungs very often show lesions. In some cases, however, the lungs of the adult hens show similar appearances to those of the young chicks. Several yellowish or greyish, cheesy lesions are present in both lungs. In such we often find similar greyish lesions in the intestine, notably the duodenum.

Salpingitis.

We must finally turn our attention to the oviduct, which becomes the seat of inflammation resulting from pullorum infection. Inflammation of the oviduct is frequently accompanied by mis-shapen yolks and peritonitis. It is, therefore very probable that relationship exists between the cause of all these symptoms. I must, however, draw attention to the fact that one seldom succeeds in isolating *Bacillus pullorum* from the inflamed oviduct. As a rule one finds *Coli bacillus* in pure culture. It is not at all improbable that these microbes gain their way into the diseased oviduct from the cloaca, and begin to play their chief rôle in that region.

On the other hand, it is, however, also possible that coli bacillus plays an important part in most cases of inflammation of the oviduct and that pullorum infection is not the cause of this many-sided complaint. In connection with this, I desire to draw attention to an established opinion held by many poultry keepers in days gone by, *viz.*, that the trap nest, or rather, let me say, the controls of the trap nest, is one of the principal causes of the oviduct affections. After the hen has laid, the laying organs need a short period of rest in which they contract. When controlling the trap nest, however, it occurs that hens which have just laid are handled roughly when their leg-band number has to be inspected. It is not improbable that in this way, by external means, infection of the oviduct, that has not had time to contract, takes place, resulting in inflammation of the oviduct. Whatever be the cause, it is in any case advisable to control the leg-band number with the greatest possible care.

The mucous membrane usually becomes more or less involved in the inflammation of the oviduct, and in consequence there is generally an increased secretion of albumen. This albumen fills the oviduct with a jelly-like material, or else it

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becomes clotted into compact yellowish masses formed in layers (albumen concrement). These albumen concrements vary in size from that of a nut to that of a banana or orange. On account of the abnormal irritation of the membrane of the oviduct, the muscular walls often contract in the reverse direction, and force the contents of the oviduct, such as albumen concrements and eggs with shells, into the peritoneal cavity, and set up peritonitis. Salpingitis and peritonitis are frequently associated, and their cause is often connected with one another.* Since the development of the egg takes place for its greater part in the oviduct, inflammation of this organ will most certainly influence to a large degree the quality of eggs. Should the shell-forming glands, for instance, be involved in the process, then thin shells will be the result, since these organs have not functioned so thoroughly. If the function has ceased entirely, or if the muscular movements of the oviduct has become extremely active in consequence of the irritation which is set up by the inflammation, the eggs will then be laid entirely without a shell. If the inflammation of that part of the oviduct, that part of the origin of the oviduct is accompanied by hæmorrhage, then the result will be that the albumen contains blood.

Should the inflammation involve the terminal section of the oviduct, this will be noticeable by the shells being more or less covered or smeared with blood. The eggs on the whole seem to have rather a strong taste owing to inflammation of the oviduct. Hens suffering from salpingitis (inflammation of the oviduct) can frequently be detected by the fact that the feathers around the cloacal opening or vent are soiled and matted. The cause of this is that the exudate or discharge which is formed in the oviduct, in being passed, mixes with the fæces, or that many of the affected fowls are also suffering more or less from diarrhœa. On the other hand, the abnormal secretions are retained in the oviduct, and there may not be any diarrhœa, so the vent region may appear quite normal.

Prevention.

Since we are here confronted with the most important malady, so far as it concerns the consequential mortality, it is of the greatest importance to discover the best method that will restrict or overcome it. In connection with the mortality of young chickens, we have elsewhere pointed out that it is best to destroy the entire batch in which the disease prevails in order to prevent any recovered chickens remaining virus "carriers." So far as adult hens are concerned, other methods will, as a rule, have to be adopted. It is usually owing to the fact that every now and again a hen suddenly dies that makes the owner become aware of the fact that he has pullorum infection prevalent in his flock. In many

* In this way it is possible to understand how an egg with a shell can be formed within another egg. Through an anti-peristaltic movement, an egg which has already been entirely formed is forced back into the front of the oviduct. If it does not fall into the abdomen, but instead of this returns again on its way back, in doing so it passes the gland of both the albumen and shell-forming sections of the organ, and receives a coating of albumen, and afterwards that of the shell material. The presence of such double eggs leads one to conclude that the oviduct is the seat of inflammation.

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cases he has not noticed anything amiss with his fowls until he finds one dead in its pen. On the other hand, one is often told that the comb became blue, and was often accompanied by diarrhœa. Deaths began to take place in December, and when the owner seeks the assistance of the veterinary surgeon in the spring, some five birds have died with one owner, ten with another, and sometimes even as many as twenty. Thus all the symptoms point to a slow and uncertain development.

When the nature of the malady has been determined at a research institution, it is advisable, with an eye to producing eggs for hatching purposes, to discover the infected hens, and to isolate them, and eventually to destroy them. The nature of the disease is determined by means of examination of the blood (agglutination test) or, if needs be, by the intradermal test. Both methods have disadvantages. As regards the agglutination test, the technique which has to be adopted is too rough to give accurate results. In this way it can happen that one declares a hen to have negative results to-day which had been thought to be positive a week ago, and *vice versa*. It is for this reason that in the poultry world the blood test has begun to be mistrusted. One must, however, not leave the blame on the blood test ; the error is due to the fact that the poultry industry has drawn wrong conclusions as to the value of the blood test. The blood test is not a method by which all infected fowls can be eliminated. It is, however, a means which can be used in hunting down the virus carriers.

The same difficulties arise with the intra-dermal or wattle test. As regards reliability, this method is inferior to the agglutination test. We can quite understand that one feels inclined to consider this method of examination far too cumbrous, and also too costly. It is, however, well to keep in mind that we are here considering the most serious disease of poultry known to us. Even should the combating of this disease entail some expense, and not even be efficient, it is under all circumstances advisable to take action against it in one's own interest. The question is now : What must be done with those hens which are perceptibly affected, and with those that are reacting ?

In our opinion it is advisable to destroy all birds showing the disease. It will usually be found that only a few are affected. As regards the reacting birds, various ways may be adopted. As a rule, it is difficult to decide which of these ways is the best. One will have to act according to circumstances :—

(1) One can clear off the whole stock when a large percentage of the birds react, then thoroughly cleanse and disinfect the entire surroundings, and after a short period has elapsed restock with non-infected eggs, or else with non-infected day-old chicks. The greatest difficulty one encounters here is : first, to attain efficient disinfection of the ground, and, second, to obtain non-infected eggs for hatching, or non-infected day-old chicks. One must bear in mind that the disease is widely distributed, and that infected birds may pass as non-reactors, even should they have been bought from breeders whose reliability has been

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proved. Apart from the heavy costs incurred, the arguments advanced above count heavily in our opinion.

(2) Should the percentage of reacting fowls not be too great, I should give the preference to destroy all the reacting birds. It has been proved in the field, that by means of repeated blood testing, either in conjunction with the intradermal or wattle test or not, favourable results can be obtained. Nevertheless, it is well to bear in mind that one time the results will turn out better than another. This all depends on the extensiveness of the disease, likewise upon the degree of sanitary precautions taken in housing the birds, yet at the same time it will also be caused to a great extent by the inperfection of our diagnostic methods. In connection with this, we desire to draw attention to the fact that in general the agglutination test yields more reliable results in adult hens on condition that bacillus pullorum, also obtained from adult birds, is used as an antigen. It is, furthermore, of importance that tests should be taken according to the method of Beller, who attempts to prevent mortality in chickens by means of two successive vaccinations carried out on adult birds, and who in this way hopes to eliminate the building up of virus carriers.

Clinical Articles

Tuberculosis in the Horse and the Reaction to the Intradermal Test.

By G. MAYALL, M.R.C.V.S.
Bolton.

A BAY cart horse, seventeen years old, weighing 18 cwt., and costing £150 when bought, had been gradually losing flesh for some time and markedly for the last two months, and became easily tired and listless at his work. His temperature and pulse were normal, and respirations regular and as they should be. His forehand and neck were full and well fleshed, but he had fallen away in his hind quarters, and his abdomen was somewhat tucked up. He ate hay well, but his appetite as regards manger food was capricious, and notwithstanding supplementary nourishment he continued to lose flesh, and became weak and languid, and stiff in his hind legs. Bowels acted normally, and urine was passed in the usual quantity at regular intervals.

Suspecting tuberculosis, a dose of tuberculin was injected *intradermally* with a dental syringe, and the ophthalmic test was also applied. No reaction followed the sensitising dose, and fifty-two hours afterwards the two tests were repeated. On the morning of the following day there was some swelling, and slight tenderness at the site of the neck injection, but no eye reaction. At 6 o'clock in the evening the swelling was 2 in. across, and 5½ in. in length, and was gravitating

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downwards, fairly regular in outline, sensitive and diffuse. Next day it was 3½ in. wide, and 8 in. long, and gravitating down to the jugular furrow. We considered this a typical reaction, and the horse was reported to be tuberculous, and was slaughtered. *The reaction to tuberculin* in the horse seems to be much bigger in extent to that in cattle, but as regards heat and tenderness, quite as characteristic. On first examining this horse, and turning up his top lip, I found several hard elevations on the mucous membrane. These were incised, and *six calculi extracted* of the size and shape of a pea, bean, oat, and millet seeds, and weighing altogether half a drachm. (This was interesting in view of the tonsillar calculi found by Dr. Grau, as reported in the translation, " Foreign Bodies and Parasites in the Tonsillar Crypts of the Horse.")

The post-mortem showed miliary tuberculosis of the spleen in its whole extent, with fibrous patches radiate in form; there was enlargement of one kidney, and greyish induration extending into its substance for about one-eighth of its half section, the epiglottis was indurated, and the trachea stiff and hardened, and the glands of the neck slightly enlarged. The lungs seemed normal, and there was no stiffnesss of the neck or tenderness of the cervical vertebræ.

Wound from an Elastic Band.

By J. C. RIX, M.R.C.V.S.

Bexleyheath, Kent.

I AM sending you herewith a photograph of a case which, although, of course, not uncommon, I thought might serve to demonstrate the effect of prolonged pressure. An elastic band had been put around the dog's neck by a child, and remained unnoticed for fourteen days. I was called in late one evening by the owner, who suspected the injury had been done maliciously with a knife.

The hair around the lesion is clipped to the skin, and the actual depth of the wound was ¾ in. The trachea was exposed, and also a small part of the left jugular vein. The case did well under treatment, and made a good recovery.

An Interesting Tooth Operation in an Elephant.

By MAHOMMAD ISAMIL MALIK, B.Sc. (B.H.U.), M.R.C.V.S.

Special Officer-in-Charge, Civil Veterinary Department, Muzaffarpur, Bihar, India.

THE specimen was removed from a male elephant, aged about sixty years. It is part of right first lower molar. It protruded above the level of the other teeth so much that it had made a deep hole in the upper jaw, and mastication was very painful, and it was badly carious. It took about four hours to cut off the

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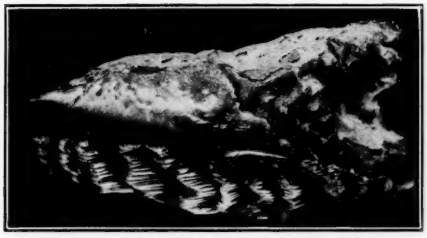
"Wound from an Elastic Band," by J. C. Rix, M.R.C.V.S. (*Page* 66.)



"An Interesting Tooth Operation in an Elephant," by J. Malik, B.Sc. (B.H.U.), M.R.C.V.S. (*Page* 66.)

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hard stone-like portion, and the operation was performed with the aid of a stone-cutting chisel and hammer. It weighed two pounds.

The specimen is now in the Odontological Section of the Museum of the Royal Veterinary College.

A Case of Intussusception in a Hen.

By ARTHUR WHITFIELD, M.D., F.R.C.P.
Harley Street, W.

I DO not know whether this accident is sufficiently uncommon to be worthy of record, but in case it may be of interest to poultry keepers, I give the clinical history of the case and the post-mortem appearances.

A white Leghorn hen in its third year of life, and in apparently good health, began to go off its food and became " mopy." It is difficult to say whether a fowl is in severe pain, but the animal appeared to be merely lethargic, sitting about on the ground, but walking freely if disturbed. After several days, during which she had refused food and begun to waste, it was thought best to kill her. My wife asked me to examine the body post-mortem, and although I thought I should be too inexpert to determine the cause of death, I did so. On opening the abdomen there was a very little clear fluid found in the peritoneal cavity; the abdominal organs at first view seemed normal, but on reviewing the intestines I noticed that the lower portion of the small intestine showed a very dark coloured mass shining through the wall. On closer examination I found that this dark coloured mass, about two inches long, was a piece of the small intestine which had become invaginated into the gut below. The point of junction where the invagination had begun showed that the gut above was closely adherent to that below, so much so that it was impossible to release the intussusception, in fact one may say that the two portions had healed together. On opening the intestine it was found that the intussuscepted portion was almost black, entirely gangrenous, and very friable, in fact it looked as if it would have sloughed away, leaving a merely shortened intestine, if the fowl had been allowed to live a few days longer. It is especially to be noted that general peritonitis was absent, and the gut above the invagination was only moderately distended. No foreign body was found in the intestine.

Abstracts of Current Literature

Veterinary Physiological Abstracts.—By W. P. BLOUNT, F.R.C.V.S.

(Concluded from Vol. 87, No. 12, p. 589.)

Hyperglycæmia.—The magnesium ion has been found to have a marked effect on the increased concentration of blood sugar in the rabbit after subcutaneous injection; both the chloride and sulphate salts were used (Horvath). It is not always possible to obtain glucose in cattle practice, but Epsom salts are nearly

always available, and apparently would suffice in cases of emergency when one requires to raise the blood sugar.

Many veterinarians still use Fehling's solution when testing urines for the presence of sugar, but it is known that there may be present in the urine other reducing substances. Leas found that cinchophen, salicylates, and tolysin reduce Benedict's solution, but neither of these ferment yeast or produce ozazones. One should be very careful therefore in pronouncing a verdict of diabetes after using only Fehling's or Benedict's solutions.

Ketosis.—Man is noted for the fact that after starvation ketosis is marked; similarly with the monkey; but glucose and food quickly abolish this condition. Friedmann found that ketosis was slight in the dog and cat, pig, goat, or rabbit after similar starvation. Benedict and Ritzman point out that in man and the carnivora residues of food in the intestine become exhausted as soon as fasting begins; in the ox, food residues may equal one-fifth of the body weight, and from this energy is derived. No acidosis or ketosis follows.

Kidney Function.—It is common for diseases of the kidney to be associated with either an excess of protein in the diet or increased diuresis. Reader and Drummond find that kidneys are not damaged by the excretion of end products following an excess of protein in the diet, and, further, they support the view that vitamin B is in relation to the protein and not the carbohydrate content of the food. Osborne found that no urinary abnormality was observed after feeding rats on a diet containing 80 per cent. protein. The kidneys hypertrophied even with a 30 per cent. protein content, but urea in the same amounts caused no such abnormality. Addis *et alia* found that an excess of protein did not injure rats after twelve months; similarly with excess acid. Excess alkali produced an excretion of R.B.C.'s, and induced a hydronephrosis in seven out of twenty-four animals. Some writers have found that after unusual amounts of nitrogenous foodstuffs nephritis was to be seen; Smith suggests that these various results may be due to the age of rats, young ones having greater powers of regeneration as compared with old rats in which lesions may have been produced. Hicks and Mitchell were not able to impair kidney function even after four months experimental polyuria in rats. No pathological changes were to be seen in the kidneys, but the livers were enlarged twice normal size. In Bright's disease there is a retention of nitrogen thirty times normal; this is not due to ammonia or uric acid, but essentially to urea retention (Widal and Laudat).

In acute nephritis of dogs, due to occlusion of the renal arteries. McEmery *et alia* found gastric secretion diminished, but in subsequent chronic cases no such effect was noticed. Urea was noted in the saliva and gastric juice (bile free), illustrating the many methods Nature adopts in her endeavour to rid herself of nitrogenous waste. Another peculiar excretory function of the stomach was encountered by Lipschutz, who ligatured the pylorus, and then injected substances intravenously. Glucose and sodium iodide were passed out into the gastric contents, but soda salicylate was excreted elsewhere.

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Menstruation.—Choline has been isolated from the perspiration of women (Klaus), and bacteria of the skin transform this into trimethylamine. Methylamine was detected in the vagina of such women. Perhaps it is one of these chemical substances which was responsible for the most peculiar actions of certain male dogs, as described by Major Stirling in the April (Vol. 87) issue of this journal.

Milk Secretion.—Campus found that both the sheep and cow give considerably more milk if injected subcutaneously with a 50 per cent. solution of saccharose. This did not modify its physico-chemical composition.

Oxygen.—In order to alleviate the symptoms of anoxæmia, Bourne and Smith tried various methods of injecting oxygen into dogs. Intravenous injections produced pulmonary embolism and heart failure. They recommended that the oxygen be pumped into the peritoneum, where maximum effects are obtained without any disturbances. As the technique is simple, this procedure will no doubt be tried in canine practice in pneumonia, anæsthetic anoxæmia, shock, etc.; it is also valuable when it is necessary to remove the intestines from their position on the kidneys in the supine animal undergoing X-ray examination of the kidneys.

Pleuritic Pain.—Unverricht has carried out experiments to determine the sensitivity of the pleura. He found that the visceral pleura (pulmonary) was insensitive to touch, pain, pressure and temperature, but that the parietal (costal) pleura was more sensitive to pressure and pain (heat) than to touch. The diaphragmatic pleura acted similarly to that of the chest wall. The central portion of the diaphragm referred the stimulus to the neck and shoulder in the form of pain sensations, the outer part of the diaphragmatic pleura to the upper abdomen over the site of the stimulus; the left side of the apex of the heart to the inner aspect of the left arm; and the right side of the heart apex to the mid-clavicular line at the level of the sixth rib. These last two examples of referred pain were initiated by the pericardium.

Polyneuritis.—Owing to the fact that *fowl paralysis* of undetermined origin is rather prevalent amongst poultry breeders this year, it has been suggested that this may be due to either a deficiency of vitamin B in the diet, or to lack of the internal secretion of the pancreas, *i.e.*, diabetes mellitus. The following notes may give assistance to workers on this problem.

Redenbaugh has found that pigeons with a deficiency of vitamin B exhibit marked hyperglycæmia, the blood sugar content being twice that of normal birds. Kon and Drummond state that the symptoms of this deficiency are: lack of appetite, acute nervous symptoms, loss of body temperature, and a characteristic hypertrophy of the adrenal glands. Kon also finds there is a failure to empty the crop completely. Although some of these signs would appear to be identical with those exhibited in fowl paralysis, Scheunert and Schlieblich point out that very much larger quantities of vitamin B are required for the pigeon than for the domestic hen to relieve the symptoms of polyneuritis. For this experiment they used fresh sugar-beet leaves, grass, and lucerne. As most diets for the fowl are "mixed," and usually contain bran, or whole grain (wheat or

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oats), there should be little lack of this anti-neuritic factor. Bierry and Killman find that the islets of Langerhans, in the pancreas of birds on a diet deficient in vitamin B, are more numerous and larger than normal; while Koppanzi finds that hens continue to live normally after resection of the pancreas, and assumes that this is due to the fact that other tissues are able to produce a hormone capable of regulating carbohydrate metabolism, *i.e.*, of secreting an insulin-like substance.

Polyuria.—In dogs this has been associated with lesions of nuclei in the infundibulo-tubercular region of the brain. The histological appearance is one of cromatolysis and neurophagia; corpora amylacea are commonly present in the cells (Corria).

Rickets.—Hydrochloric acid when added to the diet of puppies assists in the healing of rickets (Jones). Sodium carbonate retarded calcification. Calcium added to the diet had no effect unless the diets were alkaline, whilst the addition of phosphorus causes an accentuation of the signs. The urine in rickets tends to be alkaline. Healing in one limb may be facilitated by the direct exposure of that organ to ultra-violet rays.

Rumination.—Foods containing cellulose (straw, hay) are incapable of being digested by bacteria in the rumen unless there is plenty of water present to soak the food (Brahm).

Salivation in Dogs.—The conditioned reflex of this act in the dog is associated with the smell, and not the sight, of food (Kleitman). Hence dogs should always be allowed to smell the cooking of foodstuffs if one wishes to whet their appetites!

Stomach.—Cold water stays in the stomach longer than hot. After drinking one litre of water, one-half of this quantity is to be found there after fifteen minutes, while one-fifth remains until after thirty minutes (Christ). The type of animal to which this refers is not stated in the abstract.

Stomach Tube.—In man, the passage of this tube causes a marked decrease in the titrable acidity, and increases the pH of the gastric contents, thus rendering them more alkaline (Kahn and Stokes). This effect was even more marked in children when fasting. If the same conditions exist in the horse it would appear necessary to give hydrochloric or lactic acid following use of the stomach tube in order to assist digestion. Perhaps this is associated with certain fatal cases of shock following chloroform anæsthesia in association with preliminary narcosis by chloral.

Temperature.—As a result of lowering the intragastric temperature by the use of ice water, the liver also suffers, although the general body temperature remains normal (Mendelson). This may be one method of attacking hepatitis; it is also more easy to understand how a " chill on the liver " can occur in the winter months when cattle are drinking ice water for considerable periods.

Ulcers.—Adlersberg and Perutz have found that long-standing ulcers in man and rabbits can be influenced to heal quickly if 2 c.c. (forty units) of insulin be

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applied direct to the ulcer, and covered by vaseline. The application of ultra-violet rays is another method for inducing healing in chronic ulcerous sores.

Vitamins.—The effect of vitamin B on the stomach is still in dispute. Corogill finds that dogs, when suffering from lack of this accessory food substance, exhibit lack of appetite and the disappearance of gastric contractions; whereas Smith finds that dogs have normal gastric motility with the same vitamin deficiency. Gross states that loss of appetite, weight, condition, and the motor function of the bowels is lost. He found lack of vitamin A associated with respiratory disease in all his experimental animals. Intestinal hurry was present in cases of deficiency of the water-soluble vitamin C. Brouwer finds that there is enough vitamin C in grass all the year round to protect guinea-pigs from scurvy; but hay is deficient in this respect. In scurvy, iron is deposited in various organs.

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Sacro-Coccygian Anæsthesia and Uterine Torsion. By M. LEON DAUVOIS, *Doctor of Veterinary Medicine, Grigneville (Loiret). Rev. Gén. de Méd. Vét.*, No. 474, June 15th, 1931.

ACCORDING to classic authors, sacral anæsthesia by the epidural way was first carried out in France by Cathelin in 1901. In human medicine it was actually recommended to inject into the canal at the sacral hiatus 15 to 20 c.c. of an alkaline

isotonic solution of 2 per cent. novocain. French doctors seemed only to apply this method rarely, with its delicate technique, which could render valuable service in operations involving the vulvo-vaginal region and the external genital organs, for examination of the bladder and rectum, the curettage of the uterus, and suppression of pain in parturition.

German veterinary surgeons have the credit of using this method of analgesia in obstetrics, and applying it by the extra-dural way, and it was about the middle of the year 1929 that Goetze's work was made known in France by an analysis published in *Revue générale de Méd. Vétérinaire*. Such advantages were claimed there for obstetrical practice that we immediately applied the declared technique. Its simplicity caused a few practitioners to adopt it and publish their results. During a period of two years we have tested the excellence of the method in about 150 instances, including 35 dystokias, 13 prolapses of the uterus, and eight cases of uterine torsion, a great number of calvings, ovarian manipulations, and small operations practised on the vulvo-vaginal region. Our experiences lead us to maintain that the intercoccygian way for the injection is preferable to penetration by the sacro-coccygean space. French solutions of novocain (syncain, neurocain) at 2 per cent. are preferable to those of stovaine, and fresh solutions to solutions in ampoules prepared in advance. Needles or trocars, size 18/10, used by the Germans, are of an excessive diameter, which hinders the penetration of the skin and the ligament : the calibre of 14/10 ought not to be exceeded. Unsuccessful results, which are rare, are due to faulty technique, to an accentuated declivity of the posterior quarters in decubitus, to an insufficient quantity of injected solution in proportion to the dimensions of the vertebral canal, which varies according to the breed and size of the subject. The operator, advised by the clinician, ought, according to diverse circumstances, to vary the dose injected between 10 and 25 c.c. We always have recourse to the latter dose, which gives complete anæsthesia in cases where the recumbent position appears useful or inevitable in uterine prolapses of some hours duration, in uterine torsions with difficult reduction. A large experience of epidural anæsthesia causes us to declare that it has great advantages in any small interventions on the regions innervated by the fourth pair of sacrals. The operation of calving becomes less repugnant to the practitioner, who operates more cleanly, and is not hindered by defecations, expulsive efforts and uterine contractions. Whatever the Germans say, we believe that epidural anæthesia is without influence on adherence of the cotyledons.

Ovarian manipulations only appear to need analgesic intervention on some rare occasions, where prolonged contractions of the rectum hinder the proper carrying out of ovarian massage. The tension of the rectum, so-called " stove-pipe " condition of Roger and Ricand, so disagreeable when prolonged, is never influenced by epidural anæsthesia. It even seemed to us, no doubt a coincidence, that this rectal spasm was more frequent on anæsthetised cows. Even insufficient dilation of the neck of the uterus, so frequent after the reduction of uterine torsions, is not improved by analgesia.

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Prolapse of the uterus, to which in the course of a long career we have never gone to attend without a certain amount of repugnance, is reduced to a matter of real easiness even in the decubital position, if one takes care to produce complete anæsthesia. In dystokias with presentation of the hocks or buttocks, in a contracted uterus, with violent expulsive efforts of the parturient animal, so dreaded of beginners who do not make an immoderate use of the saw band, epidural anæsthesia partially suppresses the straining, and renders in such cases valuable service. We propose as the principal aim and end of this article, to comment particularly on the value of epidural anæsthesia in uterine torsions. Their remedying is facilitated in a remarkable and unexpected way. This opinion is based on experience of eight uterine torsions reduced under sacro-coccygian anæsthesia, and especially two cases of torsion in front of the os uteri which we met with last year. We have such memories of these cases in twenty-five years of practice that the expression applied by the Germans with regard to epidural anæsthesia as a " revolution in obstetrical procedure," does not appear to be exaggerated, or to surpass the reality. The impossibility of fixing the inaccessible fœtus has always rendered these reductions difficult by the rolling method, whilst in the two following cases the operation was accomplished with remarkable ease.

Observation 1.—In the cow-house of M. P., at P. à B., on the afternoon of February 28th, 1930, a strong three-year-old Normandy cow, calving for the first time, showed colicky pains for two or three hours without expulsion of the water bag. The sacro-sciatic ligaments were sufficiently relaxed to make one expect an imminent calving. The hand penetrated into a tight vagina, and ended at a soft neck closed by a thick mucous plug which did not permit the introduction of a finger. The fœtal mass was far away and impalpable. Returning backwards, the fingers found an oblique fold on the floor, not pronounced, directing itself to the left towards the vulva. No appreciable fold on the roof of the vagina. Exploration in a flaccid and empty rectum easily revealed the uterus " in hour-glass," and the zone of folds ten centimetres in front of the os uteri. The upper spirals directed forwards towards the left, the direction of the torsion to the left, as indicated by the vaginal fold, was confirmed. To the owner prognosis was reserved, as already, two years previously, one of his cows had had a torsion necessitating slaughter. The injection of 10 c.c. of a solution of stovain at 2 per cent. was made in the first intercoccygian space, and the animal, led into a shed, is hobbled, and thrown on the left side. Anæsthesia rapidly ensued. The hand introduced into the rectum showed that after a single turn over the back that the folds had disappeared. Vaginal exploration showed a soft os, and the calf in contact with it. A veritable plug of thick mucus escaped by the vulva. Dilation was rapid, and the cow expelled the calf spontaneously in an anterior presentation half an hour afterwards.

Observation 2.—In the cow-house of M. Pa., at St., on December 31st, 1930, the case concerned a second calver Normandy cow at term, in pain for two or

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three hours with acute colic, accompanied by expulsive efforts without appearance of the water bag. On exploration the vagina was tight, the neck not dilated, thick, without suppleness. The calf is away back and inaccessible. A fold on the floor coming towards the vulva from left to right accompanies a less pronounced fold on the roof, and in a crossed direction to the former, revealed a torsion to the right. The control of rectal exploration indicated the zone of torsion at ten centimetres in front of the neck. The upper folds descending forwards towards the right confirm the direction of the torsion, which appears very pronounced, and corresponding probably to a half turn. (The turn of complete torsion in this zone, which we recently found at the autopsy of a sheep four and a-half months pregnant, and some years previously in a cow after urgency slaughter at the seventh month of gestation, showed a considerable hyperæmia of the envelopes, and of the uterine mucosa incompatible, we believe, with the survival of the animal.) Foreseeing a difficult reduction, anæsthesia was produced with gr. 0.50 of syncain in 25 c.c. of water, prepared on the spot, and injected in the sacro-coccygian space. The analgesic action was immediate, and standing difficult. The cow crouched, and turned to look at the operator on feeling the needle. The effect was surprising. With a hand permanently in the rectum, and with two turns, the detorsion was complete. The calf was in contact with a soft os, but no dilation. The cow, left in sternal decubitus, was seen four hours after. The waters have been expelled, and the fore limbs up to the fetlocks are fixed in an insufficiently dilated os. Experience in similar cases shows that a long wait for unaided calving is useless, so the limbs were roped round the pasterns, returned into the uterus, and artificial dilation undertaken with the aid of the head, furnished with a simple halter checked underneath. Engaged up to the orbits in the cervical opening the head was the object of moderate and sustained traction, which in ten minutes led to complete dilation of the neck. The anterior limbs were put in place, and calving was accomplished without incident.

We thought that it was not superfluous, in spite of their similarity, to relate at length these two observations, which allow us to insist on the points which follow: At first it seems right to show some astonishment at a reduction so rapid of these two uterine torsions in front of the neck by the rolling method. These dystokias generally have a more doleful prognosis where the torsion involves the cervical region and the vagina, by reason of the impossibility which the operator finds in fixing the uterine mass. This leads us to think that epidural anæsthesia, allowing of relaxation of the folds by suppression of the pain of colic and of efforts, constitutes in such a case an incomparably effective help. Anterior torsion at the neck always provokes keen pain in the cow, and, bringing about colic, causes the notice of the owner, and makes him hurriedly call for the help of the practitioner. It is rare in this variety of torsion that one has to intervene after the period of quietude, which lasts some days, and separates the usual prodromes of parturition from a new and more eloquent crisis supervening after the death of the fœtus. One knows the difficulties that the practitioner en-

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counters when he intervenes at this second period. We recall also the impossibility that the operator has in fixing the direction of the rotation by the hand penetrating freely into the vagina, and the necessity for impressing on the beginner the classic rule that the direction of the torsion is fixed by the direction at the floor of the vagina of the fold, which goes from the neck to the vulva. This fold at the roof, when it exists, being in an opposite direction. Rectal exploration is here particularly useful, to confirm or establish diagnosis. Finally, we have serious reasons to believe that the difficulties of diagnosis of an anterior torsion at the neck, accompanying a vaginal fold often little pronounced in the standing cow, and completely indistinguishable in the decubital position, have led some practitioners into diagnostic error of stenosis and incurable rigidity of the os. One can never recommend too often to young veterinarians the systematic practice of rectal examination, of such great utility in exploration of the uterus and its annexes.

Summing up, it may be stated that sacro-coccygian analgesia in certain cases enables the practitioner to dispense with painful physical efforts, and even allows him to bring to a successful end some obstetrical interventions which otherwise he would have to abandon. These advantages are sufficient to justify the credit accorded by a few to this elegant method of anæsthesia in veterinary obstetrics.

P.S.—At the moment when this article was finished, I read a communication to the Veterinary Academy of our friend, Veterinary Doctor Roger, on torsion in front of the os, and was much interested. Without calling in question the competence of our excellent confrère, a specialist on rectal exploration and a veterinary accoucheur of repute, we express our astonishment that he has not found, in his two reported cases, the least trace of a vaginal fold, which should not have escaped him in a cow in the standing position. His communication which is so interesting, confirms us in this opinion, that rectal exploration ought to be systematically practised in painful colic in a cow at term where the os is not dilated.

Electrical Anæsthesia Applied to the Slaughter of Animals. By P. MARTI. *Revista de Hygiena y Sanidad pecuarias*, May–June, 1931. Pp. 335–340.

As a result of campaigns against certain methods of slaughter of meat animals, and notably the Jewish method of cutting the throat, Dr. Max Muller and A. Weinberger, of Munich, have studied the way in which electrical anæsthesia may be used previous to cutting the throat. In Germany, this method of electrical slaughter has been studied for several years. Kuppelmeyer, of Munich, has experimented with the apparatus of Lotterschmid and Weinberger, consisting of nippers, whose branches applied on the head of the animal are terminated by two electrodes; an interrupter is fixed near the handle of the instrument. The electrodes are applied at the base of the ears, and the current is put on for 15 to

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20 seconds. A continuous current of only 70 volts is applied, or an alternating current of 30 to 40 volts. The animal is not killed at all ; it is simply anæsthetised, and bleeding can be carried out without causing any pain.

In Berlin and Bavaria electrical slaughter is allowed. Koehl, of Kaiserslautern, has seen over 30,000 pigs slaughtered in this way without anything objectionable. The total cost of the apparatus is 180 Reich marks. The ordinary current for lighting is used, and one of a tension of 42 volts at about 10,000 phases a minute is the best, and at this strength it has a simple anæsthetising action. The heart continues to beat with its normal rhythm for a period more than sufficiently long to allow of complete bleeding, and the animal experiences no pain. The current can be stopped by an interrupter button, and if for any reason it is desired to delay slaughter, it is sufficient to interrupt the current, and after two or three minutes the animal regains its normal state. Electrocution by currents of high tension and high-frequency have given bad results by reason of cardiac paralysis and congestions and hæmorrhages in the tissues. The method has given excellent results at the Barcelona abattoir. Bleeding is perfect, and the meat has a nice appearance. A small apparatus has been constructed for domestic use on animals for the cuisine. From a humanitarian point of view it seems that one could not wish for a more desirable method.

Local Anæsthesia of the Spermatic Cord.* By Prof. Dr. E. SILBERSIEPE, and Assistant DR. H. BRESSER, Berlin.

THE castration of horses is one of the most frequent and important operations in veterinary practice. The usual thing for the lay castrator is to operate without the use of anæsthetics. From the humanitarian standpoint we should endeavour by every possible means to avoid inflicting unnecessary pain on an animal. Both local and general anæsthesia is desirable, not only on humane, but also on practical grounds, as the struggling of the animal renders the work of the operator more difficult, and exposes him and his helpers to the danger of being injured ; and, secondly, a clean operation is often impossible without the help of narcosis. The principal danger lies in the process of casting, of incurring fractures or ruptures, if narcosis is not practised beforehand. Sometimes, too, during the manipulation of the spermatic cord, unfortunate incidents happen, consequent upon the pain of the animal, which occasions severe muscular contractions, and the drawing up of the testicle. Sometimes unpleasant consequences for the operator arise in the case of unfortunate accidents to a healthy animal entrusted to his care by the owner, involving expensive and long drawn-out legal processes. Therefore in the present state of veterinary surgery *we must demand general narcosis before every operation on the horse*, especially for the operation of castration ; and in the case of the castration of older horses there should be a wider use made of

* Translated by R. Birch, from *Tierartzliche Rundshau*.

local anæsthetics. Also for the castration of a standing horse narcosis in some form or other should be demanded.

As a narcotic for the horse, in Germany and Austria, chloral hydrate is almost exclusively used. Differences of opinion now exist only in the method of its application. In the Berlin Surgical Clinic chloral hydrate is administered by the mouth diluted with the drinking water, the dose being 4 grams per cwt. And only in rare cases chloral hydrate is given as an injection for the purpose of castration. In spite of the use of general narcosis, the operation is not always entirely pain-free, and to complete this a local anæsthetic is used. Efforts to find a suitable process for the employment of a local anæsthetic have been successful, and have shown that it is possible to castrate a horse quite without pain. The Berlin Surgical Clinic, after testing different methods to anæsthetise the spermatic cord, has adopted the following technique : The horse is laid on the left side, being thrown by the Danish method, and narcotised by chloral hydrate. The preputial orifice is covered by cotton-wool and closed by two or three clips, the scrotum is thoroughly cleaned by cotton wool, and then carefully disinfected with alcohol. The line of incision is painted with iodine. The left testicle is then taken hold of and held firmly. An incision is then made in the skin of the scrotum, and the *tunica vaginalis communis* is scratched with the point of the scalpel so that only a fairly large puncture is made. Then through the slit in the *tunica vaginalis* a hollow needle is introduced deeply into the *processus vaginalis*. Cocaine solution is then injected into the lumen of the *proc. vag.* The effect of the injection is rapid, and after a lapse of from two to four minutes the scrotum and testicle hang limp, and do not react to touch. The castration can be carried out without any pain whatsoever.

This technique leaves a good impression on the owner of the horse, and on the spectators, a fact whose value is not to be underestimated in these days. In the Berlin clinic only yearlings are treated this way, whilst all older horses, with well developed scrotum and long *processus vaginalis* have, for special reasons, been for years castrated by the covered operation.

In Japan, Matsuha castrates mostly by the standing operation, and carries out local anæsthesia in the following way : After the neck of the scrotum has been caught hold of, and the testicle pulled away from the body, he injects from the near side 2 c.c. of a 1 per cent. cocain-adrenalin solution, as near as possible to the end of the inguinal canal, into the spermatic cord. He anæsthetises the scrotum by means of an injection of the same amount of solution subcutaneously at the junction of scrotum and prepuce. He recommends first of all the removal of one testicle, and then to anæsthetise the other, since then it is easier to get hold of the other spermatic cord. In eighty-four cases he has had good results with this method. Above all, he stresses the fact that by the adoption of this method contraction of the testicle and the resistance of the animal are avoided.

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Technique of Electro-Surgery in Veterinary Medicine.* By Chief Assistant Dr. W. Bolz. (From the Surgical Clinic in Berlin; Director, Dr. Silbersiepe.)

By diathermy is understood, according to Kawarschik (1928), a treatment by which changing currents of high frequency are passed through the body, or parts of the body, in order to use therapeutically the heat which those currents cause for cutting through the tissues. Except for the effect of the above heat, James Youle, an Englishman (1881–1889), asserts that the high frequency has no effect on the tissues.

In order to pass the current through the body, two electrodes are necessary. The current runs between two equally large electrodes, which are equidistant and symmetrical, *i.e.*, every point on the one electrode is parallel to the corresponding point on the other. The electrodes vary in size and form, according to the part of the body to be treated. The aim is to keep the parts lying between at an equal heat which, according to Hensler (1929), should react 70–75° C. This cannot be in the very centre of the tissues as equally and accurately measured by any other warm applications such as bandages, electric cushions, baths, etc. Furthermore, warming by diathermy has the great advantage that it affects the very heart of the illness itself, and its results remain longer than the warmth induced externally and superficially. Yakricke (1926) praises the many uses to which the high-frequency current can be put in canine practice.

A distinction must be made between the *longitudinal* application of diathermy, in which the current passes through the the body horizontally, and the *transverse* application, in which the high-frequency stream is sent vertically through the affected part of the body. The current always follows the path with the least resistance, and accordingly enters the tissues, which have the best means of conducting and can pass the greatest warmth.

According to Wildermuth (1911), the worst conductors are in the following order: Fat tissue (the worst), brain, lungs, liver, skin, and muscles. Serum and blood offer a smaller resistance to the current. Buchy (1929), in completing the experiment made by Wildermuth on the dead body, gave the following list in descending order for the living body: bones, fat, skin, muscles, nerves, body fluids. This method of producing warmth in the tissues themselves is called medical diathermy or endothermy, in contrast to electrical surgery. In the latter, both electrodes are not chosen equal, but one especially big (inactive), and a small (active) electrode (operation electrode). The current now passes from the large to the small electrode, and all streams converge from the large electrode to the smaller. Corresponding to the compression of the currents in one clearly prescribed spot, there occurs here the concentration of the resistance to warmth in the region of the electrode, which is directed to the tissues. Therefore heating is applied to the superficial layers of the body in the part where the electrode is

* Translated by Nathan Finrun from *The Berlin Animal Weekly*, (1931), No. 32.

directed ; while for the medical diathermy the most moderated heating possible is attempted in the organ, which may be set far inside the body.

The operation electrode is either round or flat. The tissue which is met by it will be eaten up by the current passing through (electro-coagulation). The sites of coagulation reach a depth which is proof of the diameter of the electrode employed. If the sparks of the electrode, which is only a short distance away, touch the tissue, a charring of this takes place owing to the high temperature. If a fine, needle-like, active electrode is used for the operation, the tissue can be split as easily as if cutting directly by a scalpel. (Electrotonic ; high-frequency cut ; melting cut ; spark cut ; light-rays cut.)

Through the high temperature of the light rays which pass across the fluid of the cell, the fluid evaporates, and the cell wall bursts. Bauer (1921) compares this event to the dividing of a covering of snow with a red-hot rod. As a result of the high temperature, an egg-white curdle occurs on the edges of the cut, and the thickness of its layers depends on the speed with which the cut is done. Electrical surgery has lately been taken notice of in humanitarian medical circles, thanks to its technical perfection, though earlier it was tried, and owing to the technical defects came into disfavour. This method is also favoured in dentistry, dermatology, surgery, etc., and especially for operating on bad tumours.

Keyseer (1928–1931) showed both in films and writing the uses to which electrical surgery can be put, especially for treating of septic carcinoma which cannot be operated on, and which has been treated in vain with X-ray and radium rays. Other authors have also achieved favourable results: Heirsch (1926–1928), Meitz-Layer (1929), V. Seemen (1929–1930), Dyroff (1930), Kirschner (1930–1931), Olivecrona (1930). In ordinary surgical operations, as a result of the danger from bacterial infection, metastasis can occur, while the electrical surgical knife remains sterile continuously during the operation, through the effect of the high-frequency current, and, furthermore, by the heat it shuts off immediately the lymphatics and blood capillaries, through which the bacterial infection takes place. Electrical surgery has a further advantage over the knife in that the operating instrument at the same time stops bleeding ; this, however, refers only to the capillaries: it cannot stop hæmorrhage of larger vessels, due to the fact that the coagulum is broken where the pulse is *vis a tergo* (Buckly, 1929). In spite of this, the lessening of the loss of blood is always worthy of notice, and desirable for the operator, as it gives him a clearer view of the field for operation. Besides the saving in blood and strength, there is a special advantage for the invalid: there is exceptionally small danger of surgical shock, and lesser effects from the larger wounds on the body. The patient recovers quickly, and the after pain is generally amazingly little. Dyroff (1930) recommends the electrical method as the ideal method for the excision of bad tumours owing to the minimum of irritation which is thereby achieved.

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The same experiments were made by us on horses. The general condition of the animals and their feeding powers were good after the operation, and only in a few cases did the temperature rise a few degrees. It was especially noticeable that after operations on the extremities no lameness developed, while in similar cases by knife operation lameness was caused. Up to the present in veterinary medicine, Jagliavini (1922) is the only one who has written, and he mentions that Bernardini used these bloodless operations for treating canker of the hoof, and obtained good results. Further attempts in the field of veterinary medicine do not seem to be recorded in veterinary literature.

The Surgical Clinic of the Veterinary School in Berlin has concentrated on this method of operating in order to see if surgical diathermy is suitable for practising on larger animals, and has therefore given particular notice to the technique. Trials have now been made over a period of nearly three years. The electrical company in Berlin of the name of Sanitas put at our disposal a " Penetrotherm Duplex " for this purpose. It can be placed at anything from nil to 1,200 watts, and according to tests by the firm it shows sparks at 20,000 per second for the coagulation, and of about 50,000 for cutting. In the application of the inactive electrodes great value is laid by humanitarian medicine on the fact that it lies steadily and equally against the skin. In order to induce a greater conductability, the skin is rubbed with spirit soap, and the electrode is bound fast to the body with an elastic band ; any folding of the bandage being avoided (Keysser, 1928). For big operations occasionally two passive electrodes are used (V. Seener, 1930) ; it is sufficient if the patient lies on one of those (Kerschner, 1930).

In animals the laying on of the inactive electrode is hindered by the thick hair, as this offers a strong resistance to the current. It is not possible, however, to shave very extensive and visible parts, especially in the cases of horses used for racing, riding, etc. Therefore, as close as possible to the part to be operated on, a bandage soaked in salt water is placed, and another is bound tight round the first. It happens occasionally, however, that after the first few movements of the animal the clamp bandage remains no longer in position ; in some cases there was a local tightening in the part which contained the current on the edge of the bandage, and as a result of over-heating a burn was left. We therefore later laid the passive electrode beneath the patient. A lead plate about 40×50 cm. was covered with a thin layer of cotton-wool, and according as to where the operation was, was placed beneath the horse. It was occasionally noticed that the electrode slipped, but in no case, perhaps due to the thickness of the horse's skin, was burning seen. The horse's body in fact offered such a strong resistance that the strength of the current needed for the operation could not always be achieved. Further, there was always swelling and heat in the region of the wound, especially with loose bandaging, and where the large vessels are, as in the inguinal region, etc.

Attempts were made to use a horse-shoe as an inactive electrode.

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The cable was fixed to the outside of the horse-shoe with a special clamp. Any fears that burning would set up in the skin of the hoof near the nails were found to be groundless. In no horse which was thus treated and watched for a week longer was there any sign of lameness or pain in the hoof through the palpation. Mensler and Fortser (1929) have also referred to its even warming of the blood circulation. It is to be supposed in these instances that the horn of the hoof, being soaked in blood, acted against this local warming.

For medical diathermy the hoof electrode was found to be necessary. The coagulation was not, however, always sufficient, even with the high natural resistance of the horny covering, to prevent the danger of over-heating. The using of this electrode was later abandoned, especially as a different electro-surgical method of operating showed better results. The disadvantage of the clamp electrode lay, apart from the undesirable method of applying it, in the large swellings that were noticed after the operation, and also that during the operation, in spite of general and local anæsthetics, twitching occurred, especially in injecting the current, and when sparks flew by chance ; and that, moreover, was found to be a disturbing factor when operating on the limbs. It is to be supposed that these twitchings are due to the effect of the warmth on the nerves, and not through irritation, as they do not occur if the bipolar method is used. In the so-called *uni-pole* method (Hirsch, 1928) a large lead plate is used for the inactive electrode, and a small needle, round or flat, is used for the operation electrode. In the *bi-polar* method, two operation electrodes are used, and both are attached to the tissue. For electrothermy, which is mostly applied in removing tumours, it is sufficient if one electrode is fixed to the pincers gripping the tumour, or a flat or button-shaped electrode is placed on the swelling, and the second needle-like electrode can then be applied to the cutting. The electrode used for cutting may be in the shape of a bow or knot ; with this, parts of the tumour can be peeled off while the button electrode is placed firmly on the swelling, and the knot-like electrode is led beneath the tissue in such a way that after the cutting is finished the button of the one electrode is in the bow of the other. This bi-polar method of operating has the greatest advantage in veterinary medicine, as it is possible to complete the circuit in the region which is being operated on. There is no need to lay the inactive electrode against the horse's hide, as the resistance is lowered, as the current does not have to pass through such large parts of the body, and burning and slipping of the electrode is avoided.

The operations were always carried out on horses lying down which had been given general (chloral hydrate) and local anæsthetics. The animal should not be in touch with any pieces of iron in contact with the ground. In the operating, experience and skill is of the utmost importance. The operation also generally lasts longer than knife operations. In cutting out deep-seated tumours, the tumour is first cut round, then the interior of the tumour taken out with the knob-like electrode, and the root is removed with two electrodes as described above, burning deeply in.

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Even if electrical surgery can never quite displace the knife, the results seem to prove that after small defects have been put aside, and when the method is perfected, it will be used for tumours which cannot be operated on in the usual way. Further, the method deserves more attention in electro-therapeutic surgery, and it will be worth while developing further methods of operating.

About the Warble Fly.—By Dr. A. Gansser of Basel. *Schweizer Archiv. Heilkunde*, March, 1931.

In June, 1930, I had an opportunity of studying egg deposition in *Hypoderma bovis* bred from the larva.

The well-developed fly was put in a roomy observation glass that was covered at the bottom with dry moss, and contained alighting objects of different kinds: a dry (prepared with alum and salt) piece of calf skin with hair attached, as well as a few hairs from a cow's tail. No preference was shown for the objects present, with the exception of the mossy layer, which the fly mostly frequented, and cowered down in a vertical position in the moss with the fore feet beating, remaining in the same place ten to twenty minutes. It propped itself with its back against a piece of moss on the glass wall, whilst the ovipositor went quickly in and out. It preserved the same position in the moss during the night. The egg deposition itself could not be noticed. After thirty hours of life the fly died.

The contents of the glass were now carefully searched for eggs, and on the floor of the vessel, deep down in the moss, five loose eggs were found which were non-pedunculated, whilst a sixth egg with the normal long-stalked grasper was firmly attached to a piece of moss. The circumstance that the fly sought out the deepest and densest places for the deposition of eggs, and avoided putting them on the hair, led us to suppose that a protected place for the deposition of the egg in nature is required. As a fact the eggs normally are placed at the root of the hair.

Another female hypoderma could not be induced to deposit eggs, although cow-hair and suitable plants were furnished. But a layer of moss was not supplied. The fly moved restlessly in the branches of the plants. It shed on these, as on the glass wall, chalky white droplets. It died after forty-eight hours. From the foregoing it would appear that in freedom (in the absence of an animal host) eggs are exceptionally deposited in moss, and it may be assumed that the fly passes the night on moss and deposits its eggs on mossy places in the meadow. Further, it is possible that eggs pass into the pharynx with the food, and not merely through licking infested hair.

This is no way strengthens the theory of infection by developing active larvæ *per os*, as we shall show further on. On the contrary, the newly noticed kind of egg deposition leads to the conclusion that in a human attack it may happen that the insect lays its eggs on pieces of clothing (woolly material); but that also eggs of young larvæ may be taken up into the mouth, or from the skin surface,

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and produce hypodermiasis of man. Indeed, the occurrence of hypodermiasis in man *per os* is as much to be doubted as the assertion that hypoderma larvæ found in the mouth of the animal host has got there *per os* (see section on œsophageal larvæ). Whether an analogous line of conduct happens with *Hypoderma lineatum* has not been determined.

Hypodermiasis.

It should be mentioned that in Switzerland hypodermiasis of man occurs more frequently than hitherto supposed. Galli-Valerio related a case, and Wegelin ("Year-Book of the St. Gall Natural History Society," Vol. 65, 1929–1930) decribes three cases in youths from eight to sixteen years old in the Bernese Oberland. These cases of parasitism occurred recently. With justification the author concludes that in at least two out of the three cases parasitism occurred through the epidermis, and not *per os*: he considers that the larvæ in men pass from the œsophagus to the neck or other regions of the body.

Œsophageal and Pharyngeal Larvæ.

The presence of œsophageal larvæ has only exceptionally been noticed in spite of the fact that we have examined numerous gullets for years. The transparent clear larvæ are difficult to see. After cleansing the connective tissue of the œsophagus it is blown up with air after the manner of a pig's bladder, and dried, and then the œsophageal larvæ are well seen. In this way twelve parasitised gullets were prepared, and it could be plainly seen that the larvæ were always and only situated in the external connective tissue of the gullet, and that they always projected over the external surface of the outer coat of the œsophagus. This corresponds throughout to the mode of exit which the larvæ have taken after reaching the œsophageal region. After a definite development period the larvæ emigrate, as is well known, from the region of the œsophagus to that of the loins. The emigration from the œsophageal zone is the period where going astray occurs, and such strayers never reach the mature stage in the normal animal host in other suckling animals or man, and they are never found in the stomach. It may be assumed from these observations that pharyngeal larvæ are such strayers, but not larvæ which had been taken up *per os*, and which had attained an advanced development stage in the pharynx. This is so improbable, seeing that a further development of the hypoderma larva through several moults has never been noticed at one and the same place. In each stage the larva, so to speak, has a fresh place of abode. Their great motility has been noted by Wegelin in the hypodermiasis of man. Larvæ with spines always travel in the line of least resistance (like awns on a coat sleeve). Therefore localisation in men and animals is normal or abnormal. It is also improbable that pharyngeal larvæ develop from eggs or fresh-swallowed larvæ which have reached the œsophagus *per os*, and established themselves there in order to attain a further development stage (absence of œsophageal larvæ on the inner side of the gullet). The so-called pharyngeal larvæ are like other strayers, such as those found between the

vertebræ, in the kidneys, and those localised in other parts of the body. (In the middle of December a freshly-prepared œsophagus was kept in a heated room, and the forward movement of a larva was observed. In about one hour it had travelled about five centimetres in the long direction of the œsophagus, and in the dried membrane its track was quite visible. Herr Dr. Verger, of the Basel abattoir, provided the material for observation.)

Correspondence

PICA AND ITS RELATIONSHIP TO TRYPANOSOMIASIS.

To the Editor of THE VETERINARY JOURNAL.

SIR,—The article on the above subject was submitted by the Animal Health Committee of Nigeria, and not be me personally. It wâs forwarded by me as Chairman of the Committee, which is composed of the Deputy Director, Tsetse Investigation; the Pathologist (Dietetics); the Senior Conservator of Forests, Northern Provinces; the Deputy Director, Geological Survey, Water Section; the Veterinary Pathologist, and myself. The Committee was formed with the object of ensuring the close co-operation of those departments of Nigeria that are directly or indirectly concerned with the problems of animal health. The article in question is an indication of what can be done by the voluntary and wholehearted co-operation of various technical departments as opposed to the principle, too long in operation, of specialists working in watertight compartments.—I am, Sir, yours faithfully,

W. W. HENDERSON.

Veterinary Department, Vom, Bukuru,
Northern Nigeria.
December 11th, 1931.

Reviews

Veterinary Obstetrics. By W. L. WILLIAMS, *Professor Emeritus in the New York State Veterinary College at Cornell University*. 2nd ed. London: Baillière, Tindall & Cox. Price 37*s*. 6*d*.

IT is with pleasure that we review the second edition of Professor Williams' work. He has had unique experience of the breeding problems of the large domestic animals, and his conclusions are authoritative. In the preface he points out that recent facts necessitate a radical departure from traditional views regarding the diseases of parturition. It was accepted that the subject was chiefly concerned with the cure of the effects of miscellaneous accidents which interfered with, or prevented, normal birth. The present treatise, however, is based upon the belief that the pathological phenomena of obstetrics are natural, that they are predictable, and are subject in an important degree to control. He considers that research has made it apparent that these phenomena are clearly registered in lesions of the fœtal membranes, the fœtus, and the uterus. It is pointed out that much has been written regarding the hygiene of pregnant animals, but the measures introduced have had no outstanding effects in reducing the incidence of dystokia and the other abnormalities of parturition. A definite stand is taken that physiological reproduction is fundamentally dependent upon the mating of two sexually healthy individuals. The ninth day after parturition is

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generally accepted as the most favourable date for service in the mare. Many mares, however, have a definite endometritis at this period, and available data indicates that abortion is three or four times as probable from ninth day than from later conceptions.

Referring to dairy cattle, the vast majority of abortions, dystokias, and retained afterbirths occur in the first pregnancy. One of the fundamental causes of this is ascribed to the fact that the burden of reproduction is placed upon immature heifers. These are only a few of the arguments put forward by the author for his view that the diseases of parturition are in no way accidental: there are many others. Such views, of course, necessitate that the teaching of obstetrics shall be conducted from a different angle; not with the care and management of the pregnant female, but with the production of individuals physically suitable for breeding of healthy offspring. Whilst the obstetrical problems of the horse and dog are dealt with, the work essentially applies to the diseases of the parturient cow. This is the most important field of veterinary obstetrics.

Referring to the operation of Cæsarean section in the dog, the writer quotes the case of the dwarf bulldog type, and states that the abnormally large and compressed cranium, with decreased development of the caudal end of the body, with a small pelvis, and a corkscrew tail, is moving towards a Cæsarean section race. He quotes a colleague having performed 770 Cæsarean sections in the past fifteen years in this type of animal. The operation is anticipated, and is performed before labour commences.

Our experience in this country does not satisfy us, however, that this is necessary, at any rate, in our broad-headed breeds. The breeding of the bulldog, French bulldog and Pekingese is quite an industry, and whilst one agrees that dystokia is rather more common than in other breeds, we consider that physiological parturition is still the rule, and dystokia only the exception. The work is well produced by the author; it is lavishly supplied with coloured plates and illustrations, and we confidently recommend it to both practitioners and students, who will find it invaluable.

Recent Advances in Biochemistry.—By J. PRYDE, M.Sc., B.Sc. 3rd ed. London: J. & A. Churchill, London, 1931. Pp. x + 393. 42 illustrations. 12*s*. 6*d*.

RELATIVELY little change has been made in this book since its first edition, as there are only four additional illustrations, and about fifty more pages, but the subject matter has undergone considerable revision, with some replacement of chapters. "Protein Structure and Proteolytic Enzymes," and "The Cholane Series" are inserted to the exclusion of "Colloids, and the Physical Chemistry of Proteins," and "Chemotherapy." The pages devoted to amino acids and urea formation are of definite value to those interested in kidney function, as is the nucleo-proteins because of its interesting account of uricolysis. The next two chapters on sulphur compounds and the rôle of tyrosine, give adequate accounts of these complexities, and carbohydrates is also fully discussed. Further chapters are devoted to the biochemistry of fats, and phosphorous compounds.

The ninth chapter gives an illuminating account of sterols and bile acids, but as calculi of the biliary system are not common in domestic animals, its practical applications are limited. We find, however, a vast amount of food for thought in vitamins. It is stated that "the animal world is dependent upon the plant world for its supply of vitamins," but there would appear to be scattered amongst the literature some evidence at least which favours the view that certain accessory food factors can be synthesised by animal tissues. The relationship between carotin and vitamin A is outlined, as is the incidence of eye disease in experimental animals fed on a diet

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deficient in this vitamin. Vitamin B is now divisible into four components, with the possibility of a fifth. Unfortunately, some of the evidence is rather slender, but, nevertheless, the material presented is most absorbing. The paragraphs on the effect of light in preventing rickets in relation to the sterols is described lucidly, but " hypervitaminosis " could be amplified with advantage. The simple student of physiology seldom appreciates the complexity of the many types of hæmoglobin found in different animals, consequently the eleventh chapter should prove fascinating. The book is concluded with a twenty-page explanation of the chemical basis of specific immunological reactions.

Recent Advances in Physiology.—By C. LOVATT EVANS, D.Sc. F.R.S. 4th ed. Pp. xii + 446. 113 illustrations. 1930. London: J. & A. Churchill. 12*s*. 6*d*.

SINCE its inception, this book has increased by forty-four illustrations and eighty-two pages; nine of the original chapters are retained, and since the last edition was published in 1928, two new chapters have been added. As further volumes on different aspects of biology are produced, so it frequently appears that a given chapter of one belongs more accurately to another writer's sphere of work, as an instance: Chapter II of the original volume of " Recent Advances in Physiology " on the Origin of the Blood Cells and their relation to the Connective Tissues, has been omitted, presumably to be expounded by the author of " Recent Advances in Hæmatology."

Professor Lovatt Evans' first chapter contains two delightful X-ray photographs of the very complicated arterial system of the heart. The next chapter also deals with the circulation, namely, the part played by the carotid sinus in the regulation of the circulation. The existence of an important zone in the region of the bifurcation of the common carotid artery which reflexly controls the heart-rate and vasomotor tone by stimuli arising for the most part by distension of the walls of blood vessels in this region, is discussed. A further chapter is devoted to the capillary circulation, part of which concerns surgical shock. The pages relating to the carriage of CO_2 by the blood might reasonably have been omitted, because the latest of the twelve references given is seven years old, and therefore although in a sense modern, the subject matter seems scarcely sufficiently recent to justify its inclusion. Perhaps it would be possible to replace it by details of present-day knowledge concerning digestion, or some other aspect of the physiology of the alimentary system.

For those interested in the intricacies of the hydrogen-ion concentration of the blood, Chapter V will be adequate. Nearly 100 pages are devoted to myology, and about half of them to the study of the nerve impulse. Veterinarians will not presumably be interested in the chapter on excitability and chronaxie. The mechanism of postural reflexes and the functions of the labyrinth are most interesting, perhaps because it is amplified by twenty illustrations of experimental work on animals. The book is completed by chapters on conditioned reflexes, and the active principles of some endocrine glands. The latter is in part disappointing, particularly the reference to the parathyroid hormone. It is stated " pregnancy and lactation in normal animals are not accompanied by reduction in the blood calcium "; we know, however, of many papers published during the last five years which refute this statement, amongst which is the work of Greig, and of Dryerre and Greig. Barely four pages are allotted to this (parathyroid) aspect of physiology, but in his introduction, Professor Lovatt Evans says that " it is no direct affair of the physiologist to find and work out applications of his subject to medicine, etc.," so that one must not expect otherwise, at least in this volume. The various functions of the ovary are conspicuous by their absence; nor have the adrenals been discussed, although there are many recent references dealing with the possible function of the adrenal cortex; consequently, after reading the chapter, one feels that it is rather incomplete.

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News

GREYHOUND RACING IN GREAT BRITAIN.

GREYHOUND racing was first introduced into this country in 1926 at the Bellevue Racecourse in Manchester. The following year the White City was opened in London, and several other racecourses appeared in other parts of the country. By the end of 1927 over forty racecourses were already planned, or in contemplation, and those at the head of the enterprise realised that in the public interest a national controlling body, to have independent supervision over the conduct of racing, was essential. Accordingly, following a meeting at Wembley Stadium, under the chairmanship of Major-General the Right Hon. J. E. B. Seely, a committee was formed under the Earl of Kilmorey, which established the National Greyhound Racing Club, with Captain A. E. V. Stanley as its first Senior Steward.

At the same time the racecourse managements themselves formed a federation under the style of The National Greyhound Racing Society of Great Britain, whose jurisdiction should be over administrative matters, and the protection and enhancement of the interests of the sport in public life. Lord Askwith became its President, and still remains so.

From the commencement, the Stewards of the National Greyhound Racing Club help to secure for the sport a confidence in the public mind, which has been shown in the enormous number of spectators who annually witness it. They established a register of greyhounds and a system of identification which is without parallel in any other form of sport, and which is practically flawless. They appointed a number of travelling stipendiary stewards, who visit all racecourses to make frequent inspections. The stewards themselves at headquarters hold inquiries into all reports of improper practices, and publish their findings in the National Greyhound Racing Calendar.

The Society, on its side, has drawn up and administered a code of rules for the administration of all licensed racecourses. In particular it has recently established, in the interests of the general public, the Greyhound Racing Totalisator Control Board, which supervises the operation of totalisators on all licensed racecourses, and makes frequent examination of totalisator accounts through its appointed chartered accountants.

Both the Society and the Club, and by the same token the Managements themselves, are at one in the belief that the success of the sport and the measure of its usefulness to the people lies in the maintenance of the highest integrity in the conduct of the sport, and in ensuring that, of all dogs, the greyhound at least shall not have a bad name.

Personal

BY the death of Dr. Stenhouse Williams, the Director of the Dairy Research Institute of the University of Reading, the veterinary profession has lost a good friend, and the cause of clean milk and hygienic dairying loses one of its most ardent and valued supporters. For more than twenty years Dr. Stenhouse Williams has laboured for the uplifting of the dairying industry, and it is largely due to the individual efforts of this scientist, and his devoted band of colleagues (amongst whom is included the present popular President of the Royal College of Veterinary Surgeons, Mr. Male) that the county of Berkshire holds one of the highest reputations in Great Britain for clean milk. His name was known world wide, and his unexpected death has come as a great grief to his very large circle of friends.

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